



## 3D Printing in the Classroom

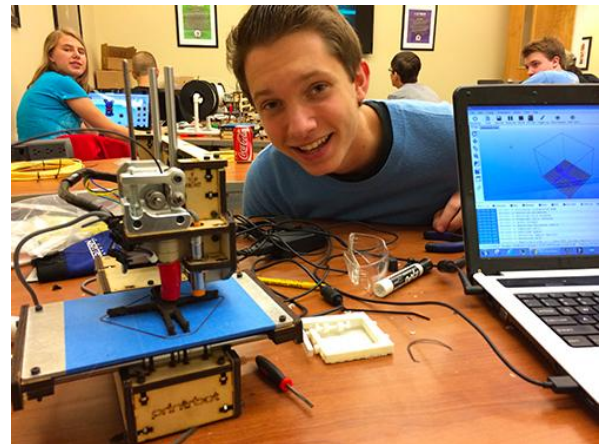
Assistive Technology · Universal Design for

## 3D Printing in the Classroom

Engaging learning environments often provide students multiple opportunities for the perception and comprehension of academic content. One such method is to pair models or manipulatives with text, audio, or video. For example, tactile representations from a literature selection, math manipulatives, hands-on science labs, or even historical artifacts from a social studies class. This is not always possible as at some point physical representations of objects may be too big, too small, too fragile, or even too dangerous. 3D printing provides a pathway to make physical representations of almost any conceivable object, concept, or idea.

## What is 3D Printing?

3D printing is the process of converting a multi-dimensional digital file into a three-dimensional physical object. Projects can be imported from online community libraries or by replicating an item with a specialized scanner that creates a digital file of a real object. Users can also create custom models by using drag and drop programs such as [TinkerCad](#) or [3DTin](#). 3D printers use a process of depositing multiple layers of plastic, rubber, metal, wood, wax, Cacao substance depending on the type of 3D



Additional resources and project libraries:

- What is 3D Printing? - <http://3dprinting.com/what-is-3d-printing/> - learn more about 3D printing

- 27 Great 3D Printer Filament Types - <https://all3dp.com/best-3d-printer-filament-types-pla-abs-pet-exotic-wood-metal/> - guide for regular and exotic 3D printer filaments
- 3D Printer Reviews - <http://www.toptenreviews.com/computers/3d-printers/best-3d-printers/> - evaluation and comparison of printers by performance, filament, size, and cost
- Thingiverse - <https://www.thingiverse.com/> - library of ready to print 3D projects
- Youmagine - <https://www.youmagine.com/designs/latest> - library of ready to print 3D projects

## UDL in 3D

When designing flexible learning environments that meet the needs of all students, 3D printing is a natural fit. Through a Universal Design for Learning lens 3D printing:

Promotes student engagement.

- Collaborative activities help students connect with and work with others.
- Provides a method of creating resources and supports for task completion.
- Recruits students' interest.



Provides an alternate means of representation that can increase perception, comprehension, and reduce language barriers.

- Presents a medium to anchor instruction or teach prerequisite skills.
- Provides a mechanism to compare and contrast objects.
- Promotes understanding across languages.

Provides options for expressive skills.

- Compatible with most computer-based design programs and assistive technologies.
- Flexible to allow students an alternative method for expressing thoughts that cannot be articulated through print, speech, or other multimedia.
- Motivational for students to build skills and become architects, engineers,

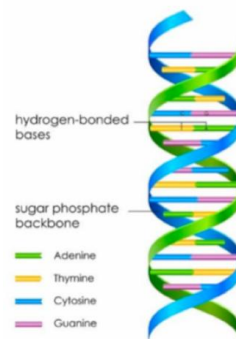
and inventors, limited only by their imagination.

#### Additional Resources on UDL:

- National Center on Universal Design for Learning - <http://www.udlcenter.org/> - resources to support the effective implementation of UDL
- The Three Principles - [http://www.at-udl.com/tutorials/udl\\_principles/](http://www.at-udl.com/tutorials/udl_principles/) - online module that includes an overview of the 3 principles, interactive lessons, resources, and implementation support activities
- UDL Infographic - <http://www.tlc-mtss.com/assets/udl-infographic.pdf> - highlights research, principles, and a variety of resources for reading, writing, math, and science

### 3D Printing for Students with Disabilities

Science, technology, engineering, and math (STEM) curricula often rely on the use of imagery for conveying information. Images from telescopes, microscopes, topographical maps, and satellites help students grasp the relationships between concepts and objects and are effective companions for printed text. Not having access to the same images is a barrier for students with vision impairments. Students with learning disabilities, autism, intellectual disabilities, and traumatic brain injuries may also benefit from the additional tactile and spatial information provided by a 3D object. To eliminate barriers, consider:



- Converting 2D images to 3D printed objects.
- Adding Braille to manipulatives.
- 3D printing objects that are viewed through a microscope.

#### Additional Resources:

- African Fossils - <http://africanfossils.org/> - digital 3D fossils and artifacts from Africa that can be explored in a browser or downloaded for 3D printing
- Smithsonian X 3D - <http://3d.si.edu/> - digital 3D models from the

Smithsonian collection that can be explored in a browser or downloaded for 3D printing

- Selva - <http://www.selva3d.com/> - online app for converting 2D images, drawings, and logos to 3D viewable and printable files
- Tactile Picture Books Project - <http://tpbp.wpengine.com/> - University of Colorado Boulder project that converts children's books in 3D tactile objects with braille

## **Video - 3D Printing in K-12 Education**

The video, [3D Printing in K-12 Education](#), provides an overview of several of the resources outlined in this newsletter. Highlights include:

- The process of 3D printing
- Project libraries
- Creating and printing classroom manipulatives

The video is available with closed captions.

## **Connecting the Technology and Learning**



Reading - provide options for perception and comprehension

- Print tactile objects from stories and textbooks.
- Convert 2D textbook images to 3D printed objects with braille.
- Print customized line or paragraph reading tools.

Writing - provide options for action and expression

- Print a diorama to summarize a concept or show understanding.
- Print customized pencil grips.
- Turn abstract concepts into printed visual objects for writing prompts.

Math - provide options for mathematical expression

- Print customized manipulatives.
- Print geometric shapes.
- Test formulas and equations by printing objects.

Science and Social Studies - print models to enhance understanding

- Molecules, cells, and viruses
- Tissue and organs
- Anatomical structures and fossils
- Celestial bodies
- Science Fair projects
- Physical and topographical maps
- Cultural and historical artifacts

More ideas for the classroom:

- 10 Ways 3D Printing Can be Used in Education - <http://bit.ly/2b8abxr> - infographic
- From Ideas to Reality - <http://bit.ly/2binGvH> - a collection of cross-content lesson ideas utilizing 3D printers
- Lesson Plans - Education in 3D - <http://bit.ly/2b8dyEq> - a collection of ready to print manipulatives across all content areas. To view actual models a .STL file reader such as <http://www.makerbot.com/desktop> is needed